Oct. 27, 1931. J. A. PAASCHE 1,828,746

EXPLOSIONPROOF VENTILATING UNIT

Filed July 25, 1929

Fig. 1.

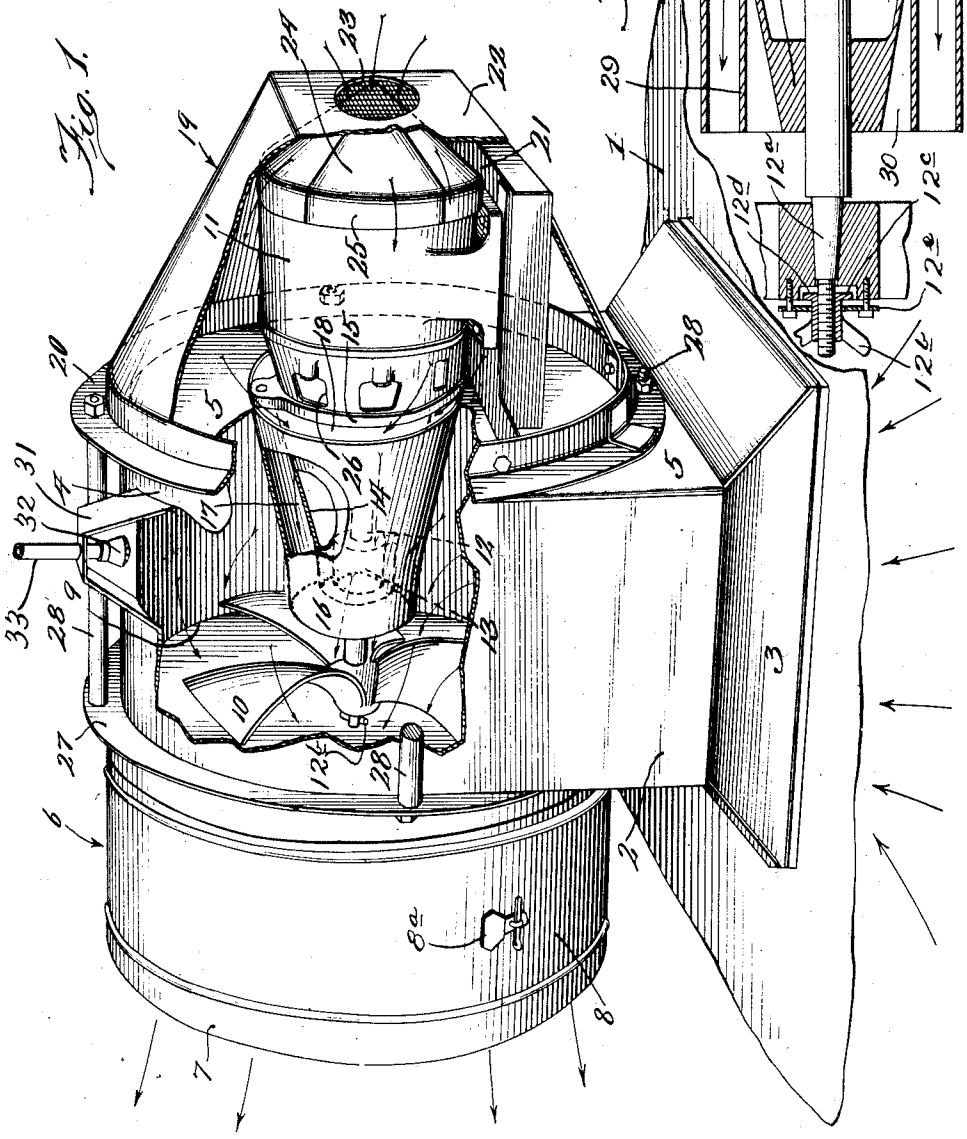


Fig. 2.

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EXPLOSIONPROOF VENTILATING UNIT

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This invention has to do with improvements in ventilating units in the form of motor-driven fans. The ventilating unit herein disclosed is especially intended for use in connection with air painting booths and the like; but it will appear that the features of the invention are not limited to this service, and that I do not intend to limit myself thereto except as I may do so in the claims. Nevertheless, inasmuch as the present construction has been devised with particular reference to the requirements of this class of service, I have illustrated and will describe this particular combination and use. In so doing, however, I wish it clearly understood that I do not intend thereby to limit myself except as I may do so in the claims.

In the operation of air painting booths and the like, there is generated a very large amount of fume and vapor from the materials being sprayed. This vapor is often of a highly explosive and inflammable nature, especially in the case of such materials as lacquers and similar highly volatile, solvent paints. These vapors are so explosive and inflammable that they will ignite under the influence of relatively small sparks, and when subjected to the influence of temperatures which are not high enough to ignite many other materials. For example, the sparks from the commutator of a direct current motor, or the heat of an overheated bearing, are sufficient to cause such ignition and explosion, especially of finely atomized dust or explosive vapors.

The ventilating unit herein disclosed includes a motor-driven fan, the motor whereof is located in a separate and distinct housing from the flue through which the air and vapors are traveling. The fan is located in said flue at a bend thereof and is connected to the motor by a driving shaft extending across the flue; and the parts are so arranged that in the normal operation the driving shaft and the back side of the fan are subjected only to a suction or partial vacuum, the motor either being completely insulated or being also subject to such partial vacuum. As a result, the current of air and vapor flows past the motor and bearing to the flue, and thence to the delivery point. Nevertheless, where the bearing and parts of the motor itself are directly reached by the inflammable vapors there exists a very considerable danger of such explosion and inflammability.

The main object of the present invention is to completely enclose the shaft bearing and adjacent parts of the motor and surround and protect them in such a manner that they are only subjected to a current of relatively cool and fresh air, which current of air comes directly from outside of the flue and housing and is therefor substantially uncontaminated by the fumes or vapors. The arrangement is also such that there is established an air space around the motor bearing, so that even in case of overheating of the bearing the heat will not be communicated to the current of air and vapor or explosive dust flowing past the same. Consequently even if there should be present explosive fumes in the room or space from which the cooling air is derived, the same could not become overheated by overheating of the bearing. This will further eliminate danger of explosions.

In connection with the foregoing it is a further object of the invention to protect the motor itself by a suitable shell or shield in such a manner that the commutator and other parts thereof will be effectively protected from the influence of dust and other foreign matter which might and frequently does cause trouble.

Still another object of the invention is to locate the driving motor itself in a separate compartment or chamber through which the air flows around the outside of the motor casing so as to effectively cool and ventilate the outside of the motor and the bearings, said air then passing through the protecting shell and around the outside of the shaft extension and bearing to a point in close proximity to the suction side of the fan. By this means said air current is at all times in circulation past the motor and outside the bearing and shaft extension and to a position beyond the same and directly to the suction side of the fan.

Another feature of the invention relates to the provision of a motor housing in the form

of an extension to the side flue itself, said extension being held in place by a pair of circular flanges securely anchored together by a number of tie bolts; this arrangement preventing the motor from getting out of alignment and also securely centering the fan in the center of the ring. Furthermore, this arrangement makes it possible to connect the motor housing to the flue in different positions, so that said motor housing may be mounted with the motor standing upright on its bracket whether the flue reaches upwardly from below or downwardly from above, or inwardly from either side.

A further object of the invention is to provide an improved attaching means for attaching the fan to the end of the shaft; the arrangement being such that by turning the nut (preferably a wing nut) in one direction the fan is tightened to the shaft whereas by turning said nut in the opposite direction the fan is pulled away loosened up and disengaged from the shaft.

A further object of the invention is to provide a sprinkler-head in conjunction with the ventilation unit itself, and located at such a point that in case of excessive rise of temperature due to ignition of fumes for example, the spray action will commence and the water will be drawn into the flue by the current of air produced by the fan itself, thereby extinguishing the fire in the flue.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

Figure 1 shows a perspective view of a flue, together with the right-angular bend and the intake and delivery connections, together with the motor housing connected to said flue; and it also shows the bearings and shaft extensions and the shields protecting the same. In this figure parts of the structure have been broken away so as to better reveal the interior construction thereof; and

Fig. 2 shows a fragmentary longitudinal section through the outboard motor bearing, together with the shield and air spaces adjacent to the position of said bearing; and also shows a detailed section through the connection whereby the fan is removably connected to the end of the shaft.

For purposes of convenience, I have shown the present device as being attached to the top sheet 1 of a spraying cabinet or booth. The same is provided with the usual delivery opening for the delivery of air and vapors. The ventilating unit includes a rectangular inlet connection or arm 2 preferably having a flat base portion 3 which may be connected to the sheet 1 around the opening thereof in any convenient manner.

The connection 2 terminates in a semicircular section 4, one side of which is closed by the sheet 5. To the other side of the structure there is connected the delivery connection 6 having the flange or thimble 7 to which a flue extension may be readily joined. If desired, the member 6 may be provided with a door or removable cover 8 which can be locked by the latch 8a, giving access to the interior thereof in any convenient manner, and for the quick removal of the fan.

The connection 2 is in direct communication with the delivery connection 6 through the side opening 9, which is of practically the full diameter of the structure. The aluminum fan 10 (of three blades or any other suitable form) is mounted for rotation in the opening 9, so that when the aluminum fan is driven, the air and vapors are drawn from the connection 2 directly up through the same and delivered sidewise through the connection 6. By making the fan of practically the full size of the opening 9 the ventilating action is carried on with a maximum of efficiency.

The driving motor 11 is located opposite to the position of the fan 10 and outside of the flue itself. Said motor directly drives the fan by means of the shaft 12, which extends from the motor across the flue and directly supports the fan. This shaft 12 is also journaled in an outboard bearing 13 placed in a tapered extension 14. This tapered extension 14 is supported by the motor head 15, so that the outboard bearing and the shaft, as well as the fan, are adequately supported notwithstanding the fact that they are located a considerable distance from the frame of the motor itself.

Surrounding the tapered extension 14 is a conical housing 16, the same being sufficiently larger than the tapered extension 14 to establish an annular passage 17 between the housing and the extension. This annular passage has its inner end 18 terminating at a point close to the motor head 15, and any air entering at said inner end 18 will flow through the annular passage and be discharged at the small end of the conical extension 16. Said small discharge end is located directly behind the aluminum fan 10 and preferably beyond the end of the extension 14, so that the bearing 13 and the end portion of the tapered extension 14 can never be subjected to any influence except that of the air flowing through the annular passage 17. Said air is generally relatively cool and clean.

The motor 11 is located within a motor housing 19. Said housing is of generally conical form the larger end thereof being provided with an annular or flange extension 20 for attachment to or against the side plate 5 of the flue. Within this motor housing there is located a platform 21 to which the motor 11 is secured. The small or back end of the motor housing 22 is drawn into a rectangular form

and is provided with a ventilating opening 23, through which fresh air may flow to and around the end of the motor. Said inflowing air will flow around the end of the motor and pass the motor and be delivered into the inlet end 18 of the annular flange 17. In this connection it will be noted that the flue wall 5 is provided with a circular opening of proper size to receive the large end of the shield 16 in a tight manner so that the inner end 18 of said annular passage is in direct communication with the space in the motor housing. Consequently the interior of the motor housing is subjected directly to the suction due to the flow and draw of air through the passage 17, and this will cause fresh air to flow in through the opening 23 already referred to.

In order to protect the end of the motor adjacent to the opening 23, I preferably place a conical shield 24 over said end. This shield may be provided with an end flange 25 which may be cupped over the end portion of the motor proper, and thus easily secured thereto.

Usually the end of the motor away from the shaft 12 is the commutator end or the end wherein are located the slip rings and brushes in the case of an alternating current machine. By completely enclosing said end by the conical cover 24 it is impossible for dust or other foreign matter to reach the interior of the motor, and thus the same is fully protected.

The other end of the motor may be provided with the usual ventilating and cooling openings 26, but since these openings are subjected to a suction (being located close to the inlet end 18 of the annular passage), it follows that there will be no tendency for dust or other foreign matter to enter the motor through the openings 26, but these openings merely act as a release out for escape of heated air.

The motor housing and other parts connected thereto are supported by the flange 20 already referred to. For this purpose a similar flange 27 is placed around the delivery connection 6 and against the other side of the flue proper; and a series of tie bolts 28 are passed through the two flanges 20 and 27 so as to draw them rigidly together. Usually one or more of these tie bolts 28 will pass through and across the flue proper, in the illustration the bottom one does this. By providing a number of these tie bolts it is possible to set the motor housing into place at a number of different angular positions so that said housing may stand upright regardless of whether the inlet end of the flue faces downwardly or upwardly or to one side.

The fan 10 may be removably connected to the shaft extension 12 by providing said extension with a tapered end 12^a onto which the fan may be forced. For this purpose I have provided a wing nut 12^b threaded onto the end of the shaft, said wing nut being provided with a flange 12^c which works in a socket 12^d in the outer face of the hub of the fan. By tightening up the wing nut the fan is wedged onto the shaft; and by forming the threads in the proper direction the wing nut will naturally tighten up due to the driving force of the shaft when rotating the fan.

A plate 12^e is secured to the outer face of the hub of the fan by screws, said plate 12^e having a hole of smaller size than the flange 12^c already referred to. Therefore by rotating the wing nut backwardly so as to unthread it from the shaft it will operate to pull the fan off from the shaft. This will make it unnecessary to drive the fan off by pounding and the like, and will thus eliminate danger of sparks which might ignite any explosive vapors present in the casing.

If desired, a sliding door may be placed over the inlet opening 23 so as to regulate and control the volume of air entering through the same. Similarly this opening may be protected by a screen or other dust removing filter, a screen being illustrated in the drawings.

If desired also, the two end bearings of the motor may be connected together by a single oiling line which can be reached through the opening 23 for oiling both bearings without difficulty. In such case the sliding door with screen is removed from the opening 23 for the purpose of oiling the bearings.

Preferably the shield 16 is flared at its delivery end as best shown in Fig. 2; and a second or inside shield 29 is placed around the bearing 13 so as to establish an air space 30 immediately around said bearing. Due to the flow of cool air through the space 17 the air space 30 will be kept cool at all times. Furthermore, in case of overheating of the bearing 13 the heat thereof will not be communicated directly to the vapor, but will flow through the ventilated passage. In this way all possible danger of explosion is eliminated, even in case the room should contain explosive vapors which would flow through the passage 17.

A hood 31 is extended upward from the central portion of the unit, and a sprinkler head 32 is placed in said hood, said sprinkler head being connected with a water supply line 33. If desired the usual thermostat control may be provided so that in case of excessive rise of temperature within the hood 31 the flow of water through the sprinkler head will commence automatically. Such water will in such case be drawn by the operation of the fan into the flue and will thus extinguish or prevent any possible fire therein.

While I have herein shown and described only a single embodiment of the features of the present invention, still I do not intend

to limit myself thereto except as I may do so in the claims.

I claim:

1. A ventilating unit for the purpose specified comprising in combination an L shaped flue having inlet and delivery connections at right angles to each other, the delivery connection having a circular opening for the accommodation of the ventilating fan, a motor opening in the structure opposite to said fan opening and in line therewith, a motor housing located outside of said flue and surrounding the motor opening, a motor supported in said housing, a drive shaft on the motor concentric with said motor opening and reaching across the flue to the fan opening, a fan on said drive shaft located in said fan opening. a conical extension on the motor reaching through the motor opening in alignment with the fan opening, an outboard shaft bearing on said conical extension the motor end of said conical extension being of smaller size than the motor opening to thereby leave an annular clearance between these parts, a shield surrounding said conical extension and separated therefrom to establish an annular passage in conjunction therewith, the inner end of said passage communicating exclusively with the motor housing through said annular clearance and the outer end of said passage terminating adjacent to the back side of the fan, substantially as described.

2. A ventilating unit for the purpose specified comprising in combination an L shaped flue having inlet and delivery connections at right angles to each other, the delivery connection having a circular opening for the accommodation of the ventilating fan, a motor opening in the structure opposite to said fan opening and in line therewith, a motor housing located outside of said flue and surrounding the motor opening, a motor supported in said housing, a drive shaft on the motor concentric with said motor opening and reaching across the flue to the fan opening, fan on said drive shaft located in the fan opening, a conical extension on the motor reaching through the motor opening in alignment with the fan opening the motor end of said conical extension being of smaller size than the motor opening to thereby leave an annular clearance between these parts, a shield surrounding said conical extension and spaced therefrom to establish an annular passage in conjunction therewith, and means for securing the inner end of said shield to the motor concentric with the conical extension, the inner end of said shield being adapted to engage the motor opening, and the outer end of said shield terminating beyond the position of the conical extension and adjacent to the back side of the fan, substantially as described.

3. A ventilating unit for the purpose specified comprising in combination an L shaped flue having a circular opening for the accommodation of the ventilating fan in one side, and a motor opening opposite to said fan opening and in line therewith, a motor housing located outside of said flue and surrounding the motor opening, a motor supported in said housing, a drive shaft on the motor, concentric with the motor opening and reaching across the flue to the fan opening, a fan on said drive shaft located in the fan opening, an outboard bearing extension on the motor, an outboard shaft bearing carried by said extension, the motor end of said extension being of smaller size than the motor opening to thereby leave a clearance between these parts, a shield surrounding said extension and spaced therefrom to establish a longitudinally extending passage in conjunction therewith, the inner end of said passage communicating exclusively with the motor housing through the clearance aforesaid, and the outer end of said passage terminating beyond the outboard bearing and adjacent to the back side of the fan, together with an air inlet opening in the motor housing at the side thereof opposite to said motor opening, and a cover plate on the motor adjacent to said opening to thereby protect the motor against the influence of dust and other foreign matter, substantially as described.

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